

2.2 Setting up GIFT with xAPI Support

In order to enable xAPI functionality for GIFT, an LRS must be available and connected to the network which GIFT is installed on. The following steps need to be completed to enable xAPI support in GIFT:

1. Install GIFT framework (refer to www.gifttutoring.org)
2. Install an LRS (see below)
3. Configure GIFT to communicate with the LRS end point

Several open source LRS options exist as well as commercial options. The following open source LRS solutions are currently available:

- Open source LRS from ADL - https://github.com/adlnet/ADL_LRS
- Hosted LRS from ADL- <https://lrs.adlnet.gov/xapi/>
- Open source LRS from learning locker - <http://learninglocker.net/>

Configuration of xAPI End Point. Once GIFT and the LRS are installed, GIFT must be configured to communicate with the LRS endpoint. The following steps must be undertaken to allow GIFT to communicate with the LRS:

1. Open the `LMSConnections.xml` file located in the `<GIFT Root>\GIFT\config\lms` directory
2. Select edit, and add a new connection entry under the `<LMSConnections>` root using the following information format and entering the username, password, and URL for the LRS installation between the XML elements:

```
<Connection>
  <enabled>true</enabled>
  <impl>lms.impl.Lrs</impl>
  <name>LRS Name</name>
  <Parameters>
    <networkAddress>https://lrs.url</networkAddress>
    <username>username</username>
    <password>password</password>
  </Parameters>
</Connection>
```

2.3 GIFT as a Producer of Interoperable Data

Once configured, GIFT is enabled to act as a producer of xAPI data. As a producer, once a training scenario is completed, the course records and scores are passed to the LMS module for storage. This data is then passed to the LMS database as well as the LRS sub-module. An xAPI statement is generated for each level of the graded score nodes, and each statement is linked to their parent statement. The figure (Fig. 2.) be-

low outlines an example of data that is created and defined for the elements in the xAPI format.

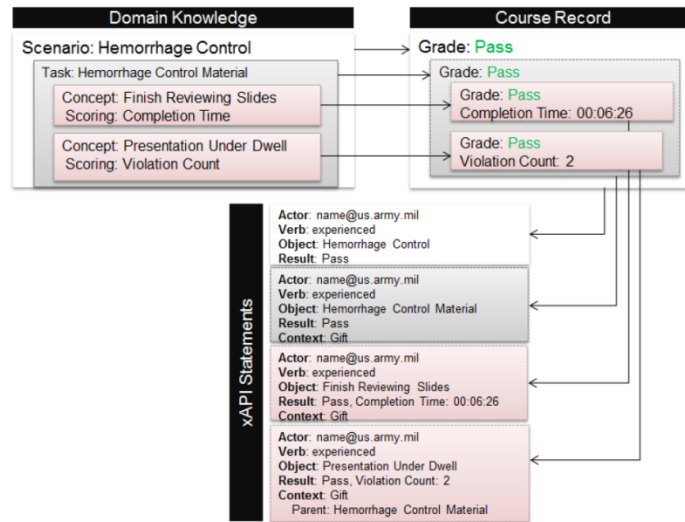


Fig. 2. An example of data from a *Domain Knowledge File*, *Course Record*, and *xAPI Statements* is shown. The example outlines the scenario, tasks, concept, and grades that are used to define the xAPI data elements. [12]

Editing Domain Knowledge File. In order for GIFT to produce xAPI data, the concepts that are represented within a course must be added to the XML file that represents the course. The following steps must be taken to update the file:

1. Edit the XML file for the course located at <GIFT Root>\Domain
2. Add a <concepts> section under the <Course> root. Below is an example of the addition of the <concepts> elements:

```
<Course name="Course Example"...>
  ...<concepts>
    <concept>Skill 1</concept>
    <concept>Skill 2</concept>
    <concept>Skill 3</concept>
  </concepts>...
</Course>
```

2.4 GIFT as a Consumer of Interoperable Data

The LMS module of GIFT also provides consumer functionality. The consumer function allows GIFT, via the LRS submodule, to poll the LRS end point. xAPI statements are used to extend GIFT's course suggestion capabilities. The LMS polling function retrieves a user's history, using their email address as an identifier when the user logs

into GIFT. The LMS module examines available course metadata definitions to find courses with concepts that match the user’s deficiencies. The LMS module then recommends concepts matching deficiencies noted in xAPI statements for which the user is “below” concept proficiency. Dynamic filtering of course suggestions is presented through the “Recommended Courses” (See Fig 3).

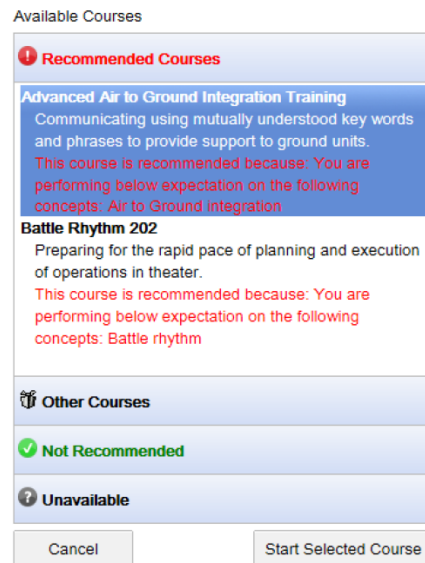


Fig. 3. A screen shot of GIFT *Available Courses* is shown. The example outlines recommended courses as determined by the LMS module by examining course metadata and deficiencies stored in xAPI statements within the LRS. [12]

3 Conclusions

GIFT allows enhanced functionality via its LMS module to integrate external data sources in a learning ecosystem. GIFT also enables data created within GIFT to be stored in an interoperable way that supports learning ecosystems via xAPI in an LRS. This functionality enables GIFT and other systems to evaluate incoming student competencies in order to better inform instructional strategy. Systems in the learning ecosystem are also enabled to make recommendations for the next training events based on performance data.

Using this functionality, researchers may test a number of different use cases and functions of adaptive learning in learning ecosystems. Usage of xAPI data in learning ecosystems with GIFT and other producers will allow consumers in learning ecosystems to assess and tailor learning and ultimately, to leverage Big Data analytics to discover trends over time.

The ability to leverage xAPI data in GIFT enables the investigation of a number of research questions. For example, the Army’s current training modernization goals call for the development of persistent representations of Soldier performance in order to

support a culture of lifelong learning. In order to develop these complex student models, Soldier performance must be tracked across multiple training environments (e.g., events, simulators, courses). By producing and consuming xAPI statements, GIFT can support interoperable student models. However, while research is ongoing in this area, demonstrating interoperable performance data across multiple platforms through GIFT has yet to be accomplished. Further, the question of how best to remediate student performance using xAPI data through GIFT has yet to be investigated. A major question remains about the specific level of granularity of these xAPI statements that is most appropriate for adapting training through GIFT. It is very likely that as independent researchers develop their own solutions for adapting training based on xAPI data, the level of detail required will depend upon the specific domain and application. For the Army to reach its goal of tracking performance across a Soldier's career, however, there must be some consensus on how to standardize the granularity of xAPI statements. These, and other research questions, provide possibilities for research going forward.

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